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General Equilibrium Effects of Investment Incentives in Mexico

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and
Anwar Shah

In Mexico, reducing corporate taxes stimulates investment more than increasing the investment tax credit or the employment tax credit does.

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Mexico has experimented with several tax instruments designed to promote private capital formation. Among such initiatives were general and industry-specific tax credits, employment tax credits, and corporate tax reductions.

Feltenstein and Shah examine the relative efficacy of such instruments using a dynamic computable general equilibrium model. They carry out model simulations using three equal-yield investment incentive scenarios: increases in investment tax credits, increases in employment tax credits, and an equivalent reduction in the corporate tax rate.

Of the three, they find that reducing corporate taxes is most effective at stimulating investment in Mexico.

Various explanations are plausible for why reducing tax rates is superior to providing investment tax credits in Mexico. Mexico had high inflation and high nominal interest rates, with real interest rates negative for certain years — so firms faced severe financing constraints. In such a macroeconomic climate, firms see reduced tax rates as improving their cash flow and a signal of an improved public policy climate.

In a period of economic uncertainty and decline, nonrefundable, unindexed tax credits on new investments are less valuable than an immediate reduction in tax liability from both old and new capital.

Finally, in an open economy, reducing the tax rate increases the demand for all capital rather than new capital alone — so the relative value of domestic capital rises. Accordingly, the public increases its holdings of domestic debt, causing the price of domestic bonds to rise and real interest rates to fall, stimulating investment.

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GENERAL EQUILIBRIUM EFFECTS OF INVESTMENT INCENTIVES IN MEXICO

Andrew Feltenstein and Anwar Shah*

1. Introduction

Public policy officials in Mexico have, over the past several decades, experimented with a number of tax instruments designed to promote private capital formation. Among such initiatives were general and industry specific tax credits, employment tax credits, and corporate rate reductions. This paper examines the relative efficacy of such tax instruments using a dynamic computable general equilibrium framework.

The paper is organized as follows. Section 2 presents an outline of the tax policy environment for the corporate sector in Mexico. Section 3 presents model details. Section 4 highlights alternate tax incentives regimes and model simulation results. Finally, a concluding section provides a summary of the results.

2. Tax Incentives for Investment in Mexico

Tax incentive regimes in Mexico have undergone significant changes over time. These are briefly discussed below:

1955-1972: Between 20% (for secondary industries) and 40% (for basic industries) corporate income of Mexican majority owned enterprises was exempted from corporate taxation for periods varying between five to ten years. The same industries also could receive, upon application, exemption from certain indirect taxes and import duties on capital goods imports.

1972-1979: Industries that were seen to promote decentralization and regional development were granted import duty relief varying from 50% to 100% and reduction in corporate tax liability ranging from 10% to 40% depending upon their location and type of activity.

1979-1986: The practice of import duty exemption was continued. In addition, tax incentives certificates (CEPROFIS) providing tax credit in the

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range of 10-25%, depending upon location, and type and size of the industry, for investment in physical assets were introduced. These certificates were negotiable and could be used against any federal tax liability by the holder.

1986-Present: The tax incentive certificate scheme was significantly tightened and targeted to priority industries and preferred zones (See Appendix Table A1). The top tax credit rate for CEPROFI was raised to 40% of total physical investment in 1986. In addition Mexican-owned enterprises are eligible for employment tax credits up to 30% of three times the annual area minimum wage multiplied by the number of new jobs created. In addition, full expensing of the present value of capital consumption allowances calculated using a 7.5% discount rate was allowed in non-metropolitan areas. In the metropolitan industrialized areas of Mexico City, D.F., Monterrey and Guadalajara, only 60% of the present value of depreciation allowances could be deducted in the first year. R&D investment tax credit at 15% for the purchase of technological research (20% for small and micro enterprises), and 20% for capital purchases by technological enterprises (30% for small and micro enterprises) are currently permissible. Further details regarding the corporate income taxation and foregone revenues due to tax incentives in Mexico is given in Appendix A.

3. Model Specification

In this section we will develop the model we will use to analyze a variety of fiscal issues in Mexico. In particular, the model will be designed to look at the implications for revenues, sectoral investment, and the balance of payments of a number of different tax programs. We will consider investment tax credits, and employment tax credits. The model can be easily extended to incorporate accelerated depreciation allowances, tax holidays, and immediate full expensing. Our model will also permit experimentation with changes in the structure of indirect taxation as well as the personal income tax. The model we develop is intended to be a microeconomic optimizing structure that generates macroeconomic outputs. Since our aim is empirical implementation, much of the structure we incorporate is chosen because of the availability of data.

We use a two period general equilibrium system in which all agents have perfect foresight, and hence in period 1 correctly anticipate the prices of period 2. We need to specify the behavior of production, consumption, and government output, taxation, and deficit financing. We need also specify the exchange rate regime and the characteristics of the trade system. A solution is found for both periods simultaneously, so that we will be determining outcomes for both years, and hence corresponding rates of change.

a. Production

There are 8 factors of production and 3 types of financial assets. These are:

1-5. Capital types
6. Urban labor
7. Money
8. Domestic bonds
9. Foreign bonds
10. Rural labor
11. Land

The five types of capital correspond to the five productive sectors, which do not include agriculture, that we will describe shortly. Each of these factors and financial assets is replicated in each period, so that we have, for example, period 1 capital and period 2 capital. Period 1 money will be the numeraire. Thus the model has 22 dimensions, or prices.

An input-output matrix is used to determine intermediate and final production. This matrix is replicated in each of two years. Corresponding to each sector in the input-output matrix, value added is produced using capital and urban labor for the non-agricultural sectors, and land and rural labor in agriculture. The technology that produces this value added is sector-specific.[1] Our data source for the input-output matrix is Matriz de Insumo-Producto Anno 1980 (1988). Here a 72 sector matrix is derived which represents Mexico's technology for 1980. We have not attempted to update the matrix for the years which we will be analyzing. Since it is not our intention to work at this level of sectoral disaggregation, we have aggregated the technology to seven sectors

[1]The use of neo-classical value added functions "sitting above" an input-output matrix is common. The reader may wish to see Shoven and Whalley (1984) for articles that use this approach. An application and detailed description of functional forms is given in Feltenstein (1986).

by adding corresponding rows and columns. The resulting sectors and the corresponding sectors in the initial matrix are:

Table 1. Aggregate Input-Output Sectors

Aggregate Sector	Corresponding Disaggregated Sectors
1. Agriculture	1-4
2. Manufacturing	5,7-61
3. Petroleum	6
4. Commerce	62-63
5. Transportation	64
6. Communications and services	65-72
7. Imports	

We denote the resulting input-output matrix by A.[2]

The specific formulation of the firm's problem is as follows. Let y^j_{Ki}, y^j_{Li} be the inputs of capital and urban labor to the jth non-agricultural sector in period i. Let Y_{Gi} be the outstanding stock of government infrastructure in period i. The production of value added is then given by

$$va_{ji} = va_{ji}(y^j_{Ki}, y^j_{Li}, Y_{Gi}). \qquad (1)$$

Recall that capital is sector specific and there are two types of labor. In the case of agriculture, equation (1) takes the same form, except that land is substituted for capital and rural labor is substituted for urban labor. We are supposing that there is a single type of infrastructure, although extensions to sector specific infrastructure would present no problem. Infrastructure may be thought of, for example, as roads, communications, education, and so forth, and enters private production as an increase in productivity.

It is assumed that sector j cost-minimizes with respect to capital and urban labor, in the case of a non-agricultural sector, and with respect to land and rural labor in the case of agriculture. Sector j pays value added taxes on inputs of capital and labor, given by t^j_{Ki}, t^j_{Li}, respectively, in period i. We

[2]A program that permits the user to arbitrarily aggregate particular rows and columns is available upon request from the author.

assume that there are no taxes paid upon the use of land by agriculture, although agriculture is taxed on its use of labor.[3] We will also suppose that the sector may be given an employment tax credit. This credit is given by a percentage rebate on the value of the firm's wage bill. Hence the effective price for labor paid by sector j is:

$$\tilde{P}_{Lij} = (1 + t_{Lij} - a_{ij})\, P_{Li}$$

where a_{ij} is the employment tax credit given to sector j.
Similarly, the effective price of capital for sector j is:

$$\tilde{P}_{Kij} = (1 + t_{Kij})\, P_{Kij}$$

Thus if $\tilde{P}_{Kij}$ and $\tilde{P}_{Lij}$ are the prices of capital and labor in period i, then the prices charged by enterprises, P_i, are given by

$$\{P_i\} = va(P, Y_{Gi})(1 + t)(I - A)^{-1}, \qquad (2)$$

where $va(P, Y_{Gi})$ is the vector of cost-minimizing value-added per unit of output, subject to $P = \{\tilde{P}_{Kij}, \tilde{P}_{Lij}\}$ and Y_{Gi}, and $t = \{t_{Ki}, t_{Li}\}$.

Here we treat imports as a single product that is distinct from domestic production.[4] Thus there is no value added by factors in imports. Rather, imports require foreign exchange, which is, in turn, produced by exports.

We suppose that each type of sectoral capital is produced via a sector-specific investment technology that uses inputs of capital and labor to produce new capital. Investment is carried out by the private sector, and since the capital that is produced in one period becomes available only in the next period, the investor must pay for the input cost of its production in the current period, but will receive the revenue from that capital in the next

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[3]The interpretation of these taxes is thus as a profit tax and a personal income tax that is withheld at the source.

[4]This assumption, due to Armington (1969), permits us to avoid problems of corner solutions, that is, solutions in which a good is either entirely domestically produced or entirely imported.

period. We will assume that investment is entirely financed by domestic borrowing, so that the investor sells domestic bonds to pay his factors of production.[5] Accordingly, the investor equates the cost of borrowing, given by the interest rate, with the anticipated future returns on capital.

The investor is affected by several fiscal parameters in making his decision. He receives an investment tax credit as well as a depreciation allowance. He also pays a capital, or profit tax, on the returns to his investment. Let us define the following notation.

k_i= Investment tax credit in period i (percent).

d_i= Depreciation allowance in period i (percent).[6]

t_{ki}= Profit (capital) tax rate (percent)

C_{Hi}= The cost of producing the quantity H_i of capital in period i

r_i= The interest rate in period i.

p_{Ki}= The return to capital in period i.

P_{Mi}= The price of money in period i.

Suppose, then, that the rental price of capital in period i+1 is P_{Ki+1}. If C_{Hi} is the cost-minimizing cost of producing the quantity of capital, H_i, then future debt obligations must be equal to the return on new capital. Hence:

$$C_{Hi}(1 - k_i - d_i) = \frac{(1 - t_{k2})p_{k2} H_1}{1 + r_i} \qquad (3)$$

where r_i is the interest rate in period i, given by:

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[5]We assume that all foreign borrowing for investment is carried out by the government, so that, implicitly, the government is borrowing for the private investor but the debt thereby incurred is publicly guaranteed. In terms of Mexico, this may be viewed as the situation existing after the financial collapse.

[6]This may be interpreted as an accelerated depreciation allowance, since the firm is permitted to take the allowance in the current period, although the capital does not come on line until the next period.

$$r_i = 1/P_{Bi} \qquad (4)$$

where P_{Bi} is the price of a bond in period i.[7]

Thus all sectors in the economy pay both income and profit taxes to the government, while certain sectors, in particular agriculture, may receive subsidies. These taxes are collected by the central government which uses them to finance its own expenditure activities.

The government produces public goods using capital and labor as inputs to production. These goods are divided between those used for development, represented by capital expenditures, and those which are represented by current expenditure, and which have no direct impact on private output.[8] The government's target for the output of public goods is determined exogenously in each time period as a fraction of GDP. An attempt to model an optimizing government is thus not made.

b. Consumption

There are two types of consumers, representing rural and urban labor. We suppose that both consumer classes have the same demand patterns for goods, and that their demands for the seven different types of goods are given by constant fractions of their incomes.[9] Thus urban and rural consumers differ only in terms of their initial wealth.

The consumers maximize intertemporal utility functions, which have as arguments the levels of consumption and leisure in each of the two periods. We permit rural-urban migration in that rural workers can choose to become urban labor if the relative wage is favorable. The consumers maximize these utility functions subject to intertemporal budget constraints. The consumer

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[7]This formulation of the investment tax credit is adapted form Auerbach and Hines (1988).

[8]Current spending may, via its impact on wages, the availability of capital, and the interest rate indirectly have very considerable impact upon private output. Feltenstein and Morris (1990) and Shah (1992) examine the impact on private output of spending on public infrastructure.

[9]The assumption of equal relative spending on different goods by both urban and rural consumers is probably inaccurate. There is, however, insufficient data, for us to estimate individual demand functions.

saves by holding money, domestic, bonds, and possibly foreign currency. He requires money for transactions purposes, but his demand for money is sensitive to changes in the interest rate. The consumer receives income from his labor, from the rental on any capital or land that he owns, and from the interest payments on bonds that he has purchased. He may also receive direct transfer payments from the government. He pays sales taxes on the goods he consumes, as well as tariffs on imported goods. The consumer's bond holdings are also subject to a capital loss if the domestic interest rate falls. His maximization problem is thus:

$$\max U(x) \quad x = (x_1, x_{L1}, x_2, x_{L2}) \tag{5}$$

such that:

$$(1+t_i)P_i x_i + P_{Lui}x_{Lui} + P_{Lri}x_{Lri} + P_{Mi}x_{Mi} + P_{Bi}x_{Bi} + e_i P_{BFi}x_{BFi} \tag{5a}$$

$$= P_{Ki}(1-\delta)^i K + P_{Ai}A_0 + P_{Lui}L_{ui} + P_{Lri}L_{ri} + P_{Mi}x_{M(i-1)} + r_{(i-1)}x_{B(i-1)}$$

$$+ P_{Bi}x_{B(i-1)} + e_i P_{BFi}x_{BF(i-1)} + TR_i$$

$$\log P_{Mi}x_{Mi} = a + b \log (1+t_i)P_i x_i - c \log r_i \tag{5b}$$

$$\log P_{Bi}x_{Bi} - \log e_i P_{BFi}x_{BFi} = \alpha + \beta(\log r_i - \log e_i r_{Fi}) \tag{5c}$$

$$\log (L_{ui}/L_{ri}) = a_1 + a_2 \log \{P_{Lui} - P_{Lri}\}/\{P_{Lui} + P_{Lri}\} \tag{5d}$$

if $P_{Lui} \geq P_{Lri}$; otherwise $\log (L_{ui}/L_{ri}) = 0$

(if the representative household is rural, otherwise labor holdings are constant)

$$P_{B2}x_{B2} = s(1+t_2)P_2 x_2 \tag{5e}$$

where:

P_i = price vector of consumption goods in period i.

x_i = vector of consumption in period i.

t_i = vector of sales tax rates in period i.

P_{Lui} = price of urban labor in period i.

L_{ui} = holding of urban labor in period i.

P_{Lri} = price of rural labor in period i.

L_{ri} = holding of rural labor in period i.

α_2 = elasticity of rural/urban migration.

P_{Ki} = price of capital in period i.

K = initial holding of capital.

δ = rate of depreciation of capital.

x_{Li} = consumption of leisure in period i.

P_{Mi} = price of money in period i. Money in period 1 is the numeraire and hence has a price of 1. A decline in the relative price of money from one period to the next represents inflation.

x_{Mi} = holdings of money in period i.

P_{Bi} = discount price of a domestic bond in period i.

r_i = domestic interest rate in period i.

x_{Bi} = quantity of domestic bonds purchased in period i.

e_i = the exchange rate in terms of units of domestic currency per unit of foreign currency in period i.

P_{BFi} = foreign currency discount price of foreign bonds in period i.

x_{BFi} = quantity of foreign bonds purchased in period i.

TR_i = transfer payments from the government in period i.

a, b, c, α, β = estimated constants.

Thus the left hand side of equation (5a) represents the value of consumption of goods and leisure, as well as of financial assets. In particular, it incorporates the sales and value added tax rates that the consumer may face. The right hand side contains the value of the consumer's holdings of capital and labor, as well as the principal values and interest that he receives from the domestic and foreign financial assets that he held at the end of the previous period. Thus his budget constraint is affected by both interest and exchange rates. Equation (5b) is a standard money demand equation in which the demand for cash balances depends upon the domestic interest rate and the value of intended consumption. Equation (5c) says that the proportion of savings made up of domestic and foreign interest bearing

assets depends upon relative domestic and foreign interest rates, deflated by the exchange rate. If no holding of foreign assets is permitted, then savings is entirely made up of domestic bonds. Finally, equation (5d) is a migration equation that says that the change in the consumer's relative holdings of urban and rural labor depends on the relative wage rates. The particular form chosen for the dependent variable is so that the term in parenthesis { } has a maximum value of 1 and a minimum value of 0. Thus a_2 is the elasticity of substitution between urban and rural labor. Some interpretation is necessary here. The specification says that the representative rural household starts off in period 1 holding only rural labor. If the urban wage is higher than the rural wage, then a portion of the rural labor becomes urban labor, depending upon the elasticity a_2 and the wage differential. Labor does not move in the other direction, however, so that if the period 2 rural wage is higher than the urban wage there is no immigration back to the country. The representative urban consumer never moves any of his labor to the country. Thus the utility function of the rural consumer stays constant when he moves to the city.

The consumer saves by purchasing domestic and foreign bonds, in addition to holding money. He receives the interest payments on these bonds, as well as possible capital gains. As indicated in equation (5c) we allow for the possibility of consumer's holding foreign assets by formulating a portfolio balance model in which consumers divide their savings between domestic and foreign assets on the basis of relative interest rates deflated by the expected rate of change of the domestic currency relative to the foreign currency. There is an elasticity of substitution between domestic and foreign assets, so that we do not necessarily obtain factor price equalization.

The consumer pays market prices plus sales taxes for all goods except agriculture, which may, for some consumers, be subsidized. Personal income taxes are not paid directly by the consumer but are withheld at the enterprise level, where profit taxes are also collected. The total value of the consumer's consumption in each period must be equal to his corresponding

income, so that we do not permit personal borrowing. In the final period of the model we impose an exogenous savings rate on the consumers, as in equation (5e).[10] Thus savings rates are endogenously determined by intertemporal maximization in period 1 and are exogenously determined in the last period.

In order to generate the necessary parameters in the Mexican consumer's maximization problem we have derived consumption weights from the aggregation of the original input-output matrix.[11] We did not directly estimate an elasticity of demand for leisure, but experimented with various values. The foreign consumer is represented by an export equation which determines the total U.S. dollar amount that he will spend on Mexican exports. This total is then divided into consumption on Mexican output of agriculture, manufacturing and petroleum with shares of 0.075, 0.531, and 0.394, respectively.[12] The aggregate export equation was estimated by OLS using annual data for non-oil exports over the period 1950-1985 with the following results.

$$\begin{aligned} \log E = {} & \underset{(0.69)}{-0.88} - \underset{(-0.04)}{0.12} \log RP + \underset{(0.31)}{0.12} \log RP_{-1} - \underset{(-0.64)}{0.22} \log RP_{-2} \\ & + \underset{(2.13)}{1.75} \log U - \underset{(-0.65)}{0.77} \log U_{-1} - \underset{(-1.18)}{0.88} \log U_{-2} + \\ & + \underset{(14.05)}{0.95} \log E_{-1} \end{aligned} \qquad (6)$$

$R^2 = 0.99$ H-statistic = 1.48

Here we make the following definitions.

(a) E = Mexican non-oil exports in US$s.

(b) RP = Relative US$ price index of Mexican exports to the US price index.

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[10]The exogenous savings rate is imposed in order that consumers have a demand for bonds in the final period. Otherwise all outstanding debt would have to be paid off and, in particular, the entire stock of public debt would have to be liquidated.

[11]Consumption weights for domestic goods are derived from Matriz de Insumo-Producto Anno (1978) (1983), Table 1, while the weights for imports came from the same source, Table 5.

[12]These shares are derived from Sistema de Cuentas Consolidades de la Nacion (1985), Table 69, where we have used 1982 shares in exports.

(c) U = US nominal GNP.

The figures in parenthesis are t-statistics. We notice that US GNP and the lagged dependent variable are significant, and that the long-run elasticities all have the correct signs. The long run relative price elasticity is 4.4, while that of US GNP is 2.0.[13] Finally, we did not attempt to estimate an oil export equation, and oil exports were taken to be exogenous.

Two other equation estimations are needed to close the determination of consumption. A money demand equation was estimated using annual data for the period 1950-1985. We wish to estimate an equation of the form:

$$\log M_0^d = a_1 + a \log C_2 + a\, r, \quad \text{where} \qquad (7)$$

$$\log M - \log M_{-1} = \beta(\log M^d - \log M).$$

Here we define

(a) Md = desired stock of money

(b) M = money supply

(c) C = nominal consumption

(d) r = domestic interest rate

(e) b = an adjustment parameter representing the speed of adjustment of actual to desired stocks.

In order to maintain homogeneity in consumption, as required in the general equilibrium model,[14] we set $a_1 = 1$ and obtain

$$\log M/C = \beta\, a_0 + \beta\, a_2 r + (1 - \beta) \log M_{-1}/C. \qquad (8)$$

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[13]Thus in estimation we treat the relative price index as being exogenous, although in the general equilibrium model it is an endogenous variable.

[14]A uniform increase in the price level cannot have an effect on excess demand, as would be the case if $a_1 = 1$, if we are to demonstrate the existence of an equilibrium.

Equation (8) was estimated over the period 1950-1985 using M1 for money and replacing r by π, the inflation rate in the wholesale price index.[15] The results are

$$\log M/C = \underset{(-0.41)}{-0.37} - \underset{(-3.71)}{0.23}\, r + \underset{(7.21)}{0.83} \log M_{-1}/C. \qquad (9)$$

$$R^2 = 0.65 \qquad D.W. = 1.88$$

We may then identify the underlying parameters as

$$a_0 = -2.18,\ a_1 = 1,\ a_2 = -1.35,\ \beta = 0.17. \qquad (10)$$

so that the demand for money function given in equation (7) is

$$M = 0.113\, r^{-1.35} C. \qquad (11)$$

We must also estimate the portfolio balance equation given in equation (5c).

$$\log (x_d/x_f) = b_0 + b_1(e - e_{-1}) + b_2 \log (x_d/x_{f_{-1}}), \qquad (12)$$

where x_d, x_f represent the peso value of domestic and foreign asset holdings by Mexican consumers, respectively, and e is the peso/US$ exchange rate. This was estimated over the period 1970-1985 with annual data taken from Zedillo (1986), since there is no information on capital flight prior to 1970.

$$\log (x_d/x_f) = \underset{(2.79)}{0.28} - \underset{(-3.00)}{0.72}\, (e - e_{-1}) + \underset{(2.79)}{0.45}\, (x_d/x_f)_{-1} \qquad (13)$$

$$R^2 = 0.74 \qquad D.W. = 2.48$$

We thus note that all parameters are significant and have the correct sign. We tried a number of different specifications of the portfolio balance equation, attempting to determine an impact of relative interest rates. In none of the tests did we find interest rates to be significant, however, probably reflecting the controls that were in place on Mexican interest rates for much of the sample period.

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[15] This was done because interest rates were controlled for much of our sample period and hence do not reflect true opportunity costs. Our general equilibrium model, however, uses r.

For our current application we also require some estimate of the elasticity of rural/urban migration. We have therefore used data from the period 1970-1982 to estimate equation (5d). The resulting parameters are

$$\log (L_{ui}/L_{ri}) = \underset{(5.26)}{2.43} + \underset{(3.45)}{5.00} \log \{P_{Lui} - P_{Lri}\}/\{P_{Lui} + P_{Lri}\} \qquad (14)$$

$$R^2 = 0.54 \qquad D.W. = 1.21$$

Thus we see that the elasticity of substitution of urban and rural labor with respect to the relative wage rate is 5.0, a relatively high figure. This probably reflects the period of the sample, when urban wages were rising rapidly in response to oil price increases, and there were large movements of labor from the country to the city.

c. Transfer Payments and Government Financing

The government collects income, profit, and sales taxes, as well as import duties, and pays subsidies, and, implicitly, pays investment tax credits, depreciation allowances, and employment tax credits. In addition, the government must cover both domestic and foreign interest obligations on public debt. The deficit of the central government in period 1, D_1, is then given by:

$$D_1 = G_1 + S_1 + r_i B_0 + e_1 r_{F1} B_{F0} - T_1 \qquad (15)$$

where S_1 represents subsidies, including tax credits, given in period 1, G_1 is spending on goods and services, while the other two terms reflect domestic and foreign interest obligations of the government, based on its initial stocks of debt. Thus, for example, policies that cause the exchange rate to depreciate will increase foreign interest payments. T_1 represents total revenues of the government.

There are several types of subsidies that the government may use either to support consumption or production. The first of these is a support to value added of the sector in question given by:

$$t_{ai}(P_{Ki}Y_{aKi}+P_{Li}Y_{aLi}) \qquad (16)$$

where t_{ai} is the support rate given to the sector's value added in period i and the term in parenthesis is the nominal cost of the sector's value added. The

second type of subsidy is a guaranteed price to sectoral output. Here the government announces a support price for the sector's output. If the market price falls below this support, then some fraction of the difference is made up by the government as a direct subsidy to producers. Hence the support payments are given by:

$$(P^*_{ai} - P_{ai})y_{ai} \tag{17}$$

where P^*_{ai} is the target price of output. If the term in (17) is negative, then no subsidy is paid.

A third possible subsidy is a support paid to consumption of the sector's products. Here we suppose that the government announces a maximum price, P_{ci}, for consumption. If the market price of sectoral output rises above this in period i, then some fraction of the difference, f_i, is paid by the government, thereby reducing the effective price to consumers. Accordingly, the payment made for this is given by:

$$\Sigma f_i(P^*_{ai} - P_{ci})x_{ai} \tag{18}$$

where x_{ai} is the total private consumption of sectoral output in period i.

The resulting deficit is financed by a combination of monetization and domestic and foreign borrowing. Thus if y_{BG1} represents the face value of domestic bonds sold by the government in period 1, and C_{F1} represents the dollar value of its foreign borrowing, then its budget deficit in period 2 is given by:

$$D_2 = G_2 + S_2 + r_2(y_{BG1}+B_0) + e_2r_{F2}(C_{F1}+B_{F0}) - T_1 \tag{19}$$

where $r_2\ (y_{BG1} + B_0)$ represents the interest obligations on its initial domestic debt plus borrowing from period 1, and $e_2r_{F2}(C_{F1}+B_0)$ is the interest payment on the initial stock of foreign debt plus period 1 foreign borrowing.

d. <u>The Foreign Sector and Exchange Rate Determination</u>

The foreign sector is represented by a simple export equation in which aggregate demand for non-oil exports is determined by domestic and foreign price indices, as well as world income. Hence the foreign currency value of non-oil exports is sensitive to changes in the exchange rate as well as to domestic price

changes. We take the dollar value of oil exports to be exogenous. The specific form of the non-oil export equation is:

$$\Delta X_{no} = \sigma_1\{\pi_i/(\Delta e_i\pi_{Fi})\} + \sigma_2\Delta y_{wi} \qquad (20)$$

where the left hand side of the equation represents the change in the dollar value of Mexican non-oil exports in period i, π_i is inflation in the domestic price index, Δe_i is the percentage change in the exchange rate, and π_{Fi} is the foreign rate of inflation. Also Δy_{wi} represents the percentage change in world income, denominated in dollars. Finally, σ_1 and σ_2 are corresponding elasticities. It is then assumed that the rest of the world spends constant shares on each Mexican non-oil export. Thus equation (20) determines total spending on non-oil exports, and Mexican prices determine the volume of each export. The parameter values used to determine equation (20) are derived from the long-run values of the parameter estimates in equation (6).

The combination of the export equation and domestic supply responses then determines aggregate exports. Demand for imports is endogenous and is derived from the domestic consumers' maximization problems, which also determine their demand for foreign assets. Foreign lending has not been modelled, but has been taken to be exogenous. Thus gross capital inflows are exogenous, but the overall change in reserves is endogenous, depending upon savings behavior and demand for imports of consumers.

Apart from producing infrastructure, collecting taxes, and financing the budget deficit, the government also attempts to adjust the exchange rate. The supply of foreign reserves y_{FGi}, available to the government in period i is given by:

$$y_{FGi} = y_{FG(i-1)} + X_i - M_i + x_{F(i-1)} - x_{Fi} + C_{Fi} \qquad (21)$$

Here x_{Fi} represents the demand for foreign assets by citizens of the home country, so $x_{F(i-1)} - x_{Fi}$ represents private capital flows. C_{Fi} represents exogenous foreign borrowing by the home government.

All terms on the right hand side of equation (21) are solved from the maximization problems of the domestic and foreign consumers. The government also has a demand for assets which, we suppose is determined by an exchange rate rule. Consider Diagram 1 representing the government's exchange rate rule in period i. The horizontal axis represents the market exchange rate in period i, e_i, while the vertical axis represents the government's demand for foreign assets. In addition, let x_{Fi} represent whatever the government feels to be the critical level of foreign reserves in period i. This critical level is determined exogenously.

Let us suppose that the exchange rate in period i depreciates from the previous period. Hence $e_i > e_{i-1}$. Then, as in the diagram, we derive a unique government demand for reserves, x_{FGi}, in the diagram. Equivalently, if there is a slight decrease in the equilibrium supply of foreign reserves of the government below its critical level, then there is a sharp depreciation in the exchange rate. We may then construct excess demand by the government for foreign reserves, D_{Fi}, as

$$D_{Fi} = x_{FGi} - y_{FGi}$$

Thus the government creates a correspondence between changes in the exchange rate and movements away from the critical level of reserves. If, as an extreme case, the graph in Diagram 1 becomes horizontal at x_{Fi}, then this corresponds to a pure float when reserves fall to their critical level. This is the scenario of much of the balance of payments crisis literature.[16] A graph that is close to horizontal below x_{Fi} may be taken as representing the policy of a nervous government, while a graph that is closer to vertical reflects a relatively unconcerned policy.

4. Simulation Results

a. Calibration

[16]See, for example, Obstefeld (1984, 1986) or Krugman (1979).

The primary goal of our study is to be able to make certain quantitative judgments concerning the impact of changes in fiscal parameters on domestic real and financial variables. We wish to first simulate the model for the two year period 1987-88, the most recent years for which we have comparable data. In order to simulate the estimated form of our model, we have taken initial allocations to be the stocks at the end of 1986. Thus a unit of urban or rural labor, for example, is taken to be that quantity which earned 1 peso in 1986. A unit of capital is that amount which earned a rent of 1 peso in 1986, as is a unit of land. Stocks of money, bonds, and foreign bonds are taken to have their actual values at the end of 1986. The model is solved using a program written by the author that computes a fixed point of the intertemporal model. The program, as well as the corresponding data set which incorporates all initial stocks and estimated parameters, is available upon request from the authors.

As a first experiment we wish to see how well our model replicates reality. We thus carry out a simulation for 1987-88 in which all exogenous parameters take on their actual historical values for those years. In particular, we take oil exports to have take their actual values. We have attempted to estimate effective rates for all taxes and tariffs,[17] and have taken the real values of government spending to be the actual values in each year. In particular, investment tax credits are uniformly set at 10 percent, as are employment tax credits. We have set the desired level of foreign reserves of the government at 0, and we have set the slope of devaluation at 4 when reserves fall below the desired level, that is, if the government has negative net reserves. If reserves rise above 0, then the slope of revaluation is set at 2. Clearly these numbers are arbitrary and in reality would be subject to constant change. Nonetheless the figures chosen serve as the basis for comparison. Finally, we will also suppose that there are no supports paid for either for production or consumption. We will experiment in later simulations with tax credits. The resulting outcome is given in Table 4.1.

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[17]These are derived from recent work carried out by the World Bank in Mexico.

Table 4.1: Benchmark Simulation
(the numbers in parenthesis are historical values)*/

	1987		1988	
Nominal GDP a/	192.9	(192.9)	366.0	(397.6)
Real GDP b/	48.0	(48.0)	49.9	(48.5)
Government spending a/	45.9	(55.1)	102.4	(94.7)
Revenues a/	28.1	(28.8)	57.6	(56.4)
Government budget deficit	-17.8	(-26.3)	-44.8	(-38.3)
Exports a/	20.8	(28.9)	47.4	(47.2)
Imports a/	12.4	(18.0)	25.4	(42.1)
Trade balance a/	8.4	(10.9)	22.0	(5.1)
Inflation rate c/	135.6	(135.6)	82.4	(107.8)
Interest rate d/	103.1	(103.1)	81.6	(62.0)
Exchange rate e/	1025.7	(1025.7)	2111.7	(2249.4)
Real exchange rate f/	100.0	(100.0)	88.4	(94.8)
Change in reserves g/	-1.1	(5.8)	-3.3	(-7.0)
Net real capital formation, 1986-88				
Manufacturing			100.0	
Petroleum			100.0	
Commerce			100.0	
Transportation			100.0	
Communications and Services			100.0	

*/ Our data sources for historical values are Cuentas Nacionales de Mexico, International Financial Statistics, and various accounts made available by the Mexico division of the World Bank.
a/ In 1000 x billions of pesos.
b/ In 1000 x billions of 1980 pesos.
c/ Rate of inflation in the wholesale price index.
d/ Interest rates are annual percentage rates for 3-months treasury bills.
e/ In pesos/US$.
f/ Defined as WPI/e where WPI is the wholesale price index and e is the nominal exchange rate.
g/ In billions of US$.
h/ These are index numbers which we will use to make comparisons when we calculate the effects of introducing investment and employment tax credits.

Let us make some observations concerning the calibration of our model.

1. Nominal GDP is calculated as C + I + G + X - M. To calculate real GDP we use the GDP deflator, calculated as the price index of value added (this is very close to the wholesale price index). Thus nominal GDP in 1988 is seen to be below its actual values since we underestimate the rate of inflation in that year. We overestimate the growth rate in 1988 real GDP by about 3.0 percentage points.

2. Tax revenues are the sum of VAT, sales, and excise taxes, along with profit and income taxes, and tariffs. These correspond to the revenues of the Federal Government and do thus not represent as broad a coverage as given in the accounts of consolidated public sector. In particular, we do not include non-tax revenue or sales of public enterprises. Direct taxes are the corporate and personal income taxes, while indirect taxes are the VAT, sales, and excise taxes. We thus see that the simulated aggregate tax collections are good approximations of the actual Mexican numbers.

3. Expenditure represents expenditure of the Federal Government and therefore does not include public enterprises. In particular, the figures we have used for actual expenditures are derived as the sum of 1) Federal wages, 2)Federal purchases of goods and services, 3)Current transfers from the Federal Government, not including transfer payments to state enterprises,[18] 4) Federal capital expenditure, 5) Total interest payments. We have treated public enterprises in our consolidation as being tax-paying private firms. We note that in 1987 we slightly underestimate expenditures, possibly because we are not attributing the full debt obligations that the government actually had as an initial stock. In 1988, on the other hand, expenditures have risen above their actual value. This is largely because the simulated 1988 interest rate is higher than its actual value, causing government debt service to be higher than in reality. Accordingly, we over-estimate the size of the government's budget deficit in 1988.

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[18]We do not include transfer payment to state enterprises since in our simulations we treat state enterprises as being part of the private sector. They are thus profit maximizing and do not receive transfers.

4. The aggregate value of exports, in terms of domestic currency, underpredicts the actual amount for 1987 and becomes more accurate in 1988. Recall that we generate exports from an export equation in which oil exports are exogenous in dollar terms and non-oil exports are endogenous depending on endogenous relative domestic and foreign prices, as well as exogenous foreign income. Simulated imports are underestimated in both years, and more severely underestimated in 1988. As a result, the domestic currency value of the simulated trade balance in is overestimated in 1988. This is primarily the result of the simulated real exchange rate depreciating more rapidly in the simulated outcome than in reality.

6. The inflation and nominal interest rate movements have the correct direction of change, although the decline in inflation is over-estimated. For actual values we have taken annual averages of the corresponding indices. For inflation we use the wholesale price index, while for interest rates we use the treasury bill rate given in International Financial Statistics. The simulated figures for 1987 are calibrated to the actual rates, since no rate of change can be calculated in the first year. In 1988 we see that our model generates a slightly positive real interest rate, as compared to an actual 45 percent negative real rate.

7. The nominal exchange rate depreciates slightly less rapidly in the simulation than in reality.[19] Recall, however, that our choices for the critical level of foreign reserves as well as for the depreciation rules shown in Figure 1 are essentially arbitrary. Actually the Mexican government does not follow a single exchange rate rule for two years, and may oppose devaluation more strongly than our rule indicates. We also show a somewhat more rapid real devaluation between the two periods than actually occurred. This is mainly due to the higher than actual simulated rate of inflation.

We thus note that our model seems to generate a reasonably accurate replication of actual Mexican outcomes for 1987-88. It does therefore not seem

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[19]We are using the average exchange rates for Q1 1987 and Q1 1988 to represent actual nominal exchange rates.

unreasonable to use the behavioral structure of the model to carry out counterfactual simulations.

b. Counterfactual Simulations

(i) Investment Tax Credit Increase

First, we simulate the effects of introducing a uniform increase in the investment tax credit for all the sectors that use capital as an input to production. Recall that agriculture uses land and rural labor as inputs, while imports do not use physical inputs. Accordingly, we will suppose that sectors 2-6 are each now given a 20 percent investment tax credit. All other parameters in the simulation remain unchanged from the exercise reported in Table 4.1. Table 4.2 gives the resulting outcomes.

We thus notice that the 20 percent investment tax credit has brought about a rise in the rate of inflation in both periods, as compared with Table 4.1. This increase has been largely caused by the rise in the government budget deficit, both in nominal terms and as a percentage of GDP. Accordingly, the aggregate loss of reserves by the Central Bank is greater in this case than in the initial simulation. We see that the real interest rate has risen significantly in both periods, in response to the increased budget deficits. In addition, real exchange rates has depreciated, leading consumers to decrease their holdings of domestic debt, as compared to the case of Table 4.1. Accordingly, the price of domstic debt falls, leading to a further increase in the real interest rate. Thus, we see that there have been uniform increases in the rates of net real capital formations across sectors. These increases are somewhat less than might be expected, as the increased real interest rates tend to mitigate the positive effects of the investment incentives. Because factors are transferred from current to capital production, there have been slight declines in real GDP in both periods, as our model's time horizon is not long enough to fully incorporate the effects of the increased sectoral capital.

(ii) Corporate Income Tax Rate Reduction

Since a 20 percent investment tax credit seems to offer some stimulus to capital formation, but also seems to have certain adverse macroeconomic

Table 4.2: Impact of a 20 percent Investment Tax Credit

	1987	1988
Nominal GDP a/	211.1	432.6
Real GDP b/	47.6	49.0
Government spending a/	50.8	121.7
Revenues a/	30.8	67.8
Government budget deficit	-20.0	-53.9
Exports a/	22.0	57.5
Imports a/	13.5	29.9
Trade balance a/	8.5	27.6
Inflation rate c/	159.8	99.3
Interest rate d/	148.4	114.4
Exchange rate e/	1084.9	2531.4
Real exchange rate f/	95.9	81.9
Change in reserves g/	-1.3	-4.4
Net real capital formation, 1986-88 h/		
Manufacturing		102.5
Petroleum		105.0
Commerce		101.4
Transportation		100.1
Communications and Services		103.0

a/ In 1000 x billions of pesos.
b/ In 1000 x billions of 1980 pesos.
c/ Rate of inflation in the wholesale price index.
d/ In percent.
e/ In pesos/US$.
f/ Defined as WPI/e where WPI is the wholesale price index and e is the nominal exchange rate.
g/ In billions of US$.
h/ Index numbers based on the corresponding levels of investment in Table 4.1

effects, let us now suppose that the government attempts to generate an investment increase by reducing the tax rate on capital income. We will thus suppose that the statutory tax rate on capital income is lowered from 42 percent to 35 percent. The resulting outcomes are given in Table 4.3.

We observe that this change has had rather unexpected outcomes. In particular, we see that the rate of capital formation has increased significantly, as compared to Table 4.2. The reasons for this outcome are straightforward. The budget deficit of the central government was 9.47 percent of GDP in 1987 and 12.46 percent of GDP in 1988 in the simulation reported in Table 4.2. In Table 4.3 the corresponding figures are 9.87 and 12.08 percent. Thus, over the two years of the simulation, the reduction in the capital income tax rate has had approximately the same aggregate effect on the real budget deficit as did raising the investment tax credit. The reduction in the capital tax rate, on the other hand, has had the effect of sharply lowering the real interest rate, unlike the previous example when real interest rates rose. The reason for this change comes from the behaviour of the real exchange rate. Here, there is an appreciation in the real exchange rate, as compared to Table 4.2, as the relative value of domestic capital rises in response to the capital income tax reduction, which affects the entire capital stock. Accordingly, the public increases its holdings of domestic debt, causing the price of domestic bonds to rise and the real interest rate to fall. Accordingly, the incentive offered by the capital income tax cut lowers the cost of capital but does not increase the cost of borrowing, as did the investment tax credits. In addition, the tax cut brings about lower inflation rates and lower losses in foreign reserves than do the investment tax credits. Accordingly, under such circumstances, tax cuts seem to be superior to investment tax credits in stimulating investment.

Table 4.3: Impact of a Reduction in the Capital Income Tax Rate

	1987	1988
Nominal GDP a/	196.5	374.1
Real GDP b/	48.0	49.7
Government spending a/	46.7	103.8
Revenues a/	27.3	58.6
Government budget deficit	-19.4	-45.2
Exports a/	19.5	49.4
Imports a/	12.5	25.9
Trade balance a/	7.0	23.5
Inflation rate c/	140.0	84.0
Interest rate d/	93.2	79.9
Exchange rate e/	960.0	2143.5
Real exchange rate f/	108.7	96.0
Change in reserves g/	-1.1	-3.3
Net real capital formation, 1986-88 h/		
Manufacturing		104.9
Petroleum		109.3
Commerce		105.3
Transportation		105.6
Communications and Services		104.4

a/ In 1000 x billions of pesos.
b/ In 1000 x billions of 1980 pesos.
c/ Rate of inflation in the wholesale price index.
d/ In percent.
e/ In pesos/US$.
f/ Defined as WPI/e where WPI is the wholesale price index and e is the nominal exchange rate.
g/ In billions of US$.
h/ Index numbers based on the corresponding levels of investment in Table 4.1

(iii) Employment Tax Credit Change

Finally, let us suppose that the government attempts to use employment tax credits rather than investment tax credits as a policy instrument. In particular, we will look at a program in which the 10 percent investment tax credit from the base case is maintained. The employment tax credit is raised so that the overall deficit implications are the same as in simulation 4.2, when investment tax credits were increased. Capital tax rates are maintained at their level of the base simulation of Table 4.1 We can not solve analytically for a employment tax credit that gives precisely the same budgetary outcome as in Table 4.2. Rather, we search for employment tax credit rates that result in approximately that outcome. It turns out that a 3 percent increase in the employment tax credit, that is, an employment tax credit of 13 percent, yields the following budget neutral outcome.

We thus observe that the new regime leads to budget deficits that are almost identical, both in nominal and real terms, to those of Table 4.2. The real outcomes of this scenario are different, however. In particular, we see that, with the exception of the transportation sector, all sectors have lower rates of capital formation in this case that in Table 4.2. They thus also have considerably lower rates of capital formation than in Table 4.3, the simulation that incorporates reduced capital tax rates. We thus again conclude that a reduction in the capital income tax rate is superior in promoting investment to either employment or investment tax credits.

Table 4.4: 1987-88 Assuming a 10 percent Investment Tax Credit and a 13 Percent Employment Tax Credit

	1987	1988
Nominal GDP a/	213.0	431.1
Real GDP b/	48.0	48.8
Government spending a/	51.0	121.4
Revenues a/	30.9	67.7
Government budget deficit	-20.2	-53.7
Exports a/	22.1	57.6
Imports a/	13.6	29.7
Trade balance a/	8.5	27.9
Inflation rate c/	149.8	99.1
Interest rate d/	115.5	90.5
Exchange rate e/	1086.7	2529.2
Real exchange rate f/	104.3	89.2
Change in reserves g/	-1.3	-4.4
Net real capital formation, 1986-88 h/		
Manufacturing		102.2
Petroleum		101.0
Commerce		100.9
Transportation		100.5
Communications and Services		101.1

a/ In 1000 x billions of pesos.
b/ In 1000 x billions of 1980 pesos.
c/ Rate of inflation in the wholesale price index.
d/ In percent.
e/ In pesos/US$.
f/ Defined as WPI/e where WPI is the wholesale price index and e is the nominal exchange rate.
g/ In billions of US$.
h/ Index numbers based on the corresponding levels of investment in Table 4.1

Summary and Conclusion

We have constructed an intertemporal general equilibrium model designed to examine certain fiscal policies that have direct impacts upon investment and employment. In particular, we consider sectoral investment tax credits, as well as uniform employment credits. The model also permits the consideration of price and consumption subsidies, and can easily be extended to other policies affecting investment. Among these are accelerated depreciation allowances and immediate full expensing.

We have developed a methodology for solving the model numerically and have applied the model to Mexico. We first attempt to replicate the actual outcomes of 1987-88, and then turn to a series of counter-factual simulations. We first compare the effects of doubling the investment tax credit with those of an equal yield 16.7 percent decrease in the capital income tax rate. We observe that the overall budgetary implications of the two policies are approximately equivalent. The capital income tax reduction, however, directly lowers the cost of capital, thereby reducing the real interest rate and hence increasing the rate of capital formation, relative to the case with investment tax credit increases. Accordingly, it appears in this case that capital income tax reductions are more effective in stimulating investment than are investment tax credits. This example also indicates that simply examining the budgetary implications of different investment policies is not sufficient to predict their outcomes.

Finally, we look at the effects of a budget neutral reduction in the employment tax credit. We find that this policy is inferior to either of the other two in promoting capital formation. We conclude that, at least in the Mexican case, capital income tax reductions policy seems to be rather effective. We also note the importance of using an intertemporal model, since investment decisions are, of course, forward-looking. We also observe that investment policies effects different sectors in a non-uniform way, indicating the importance of using sector-specific capital in our model.

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Appendix A:

Corporate Structure and Investment Incentives in Mexico

The structure of corporate income taxation in Mexico has undergone major changes since early 1987. In the following, current tax structure is described with occasional references to pre-1987 tax system.

Corporate Income Tax Base and Rate: Corporate income tax base is now completely indexed. Taxable Profits (defined as gross receipts minus costs, business expenses, dividends corresponding to previous period of earnings and net losses carried forward from other periods) are subject to tax at a rate of 35% (a rate of 42% prevailed in the pre-1987 period). Depreciation deductions are indexed or as an alternative, the present value of depreciation calculated at a discount rate of 7.5% may be deducted fully in all regions except major metropolitan areas and in all sectors except the automobiles. In major metropolitan areas only 60% of such value can be deducted in the first year and the remaining 40% subjected to capital consumption allowances.

Asset Tax: An assets tax at a rate of 2% of the average value of assets of business enterprises and creditable against their income tax liability in Mexico is levied effective in 1989.

Taxation of Corporate Income. The corporate income tax base is now indexed. Taxable profits (defined as gross receipts minus costs, business expenses, dividends corresponding to previous periods of earnings, and net losses carried forward from other periods) are taxed at a rate of 35 percent (a rate of 42 percent prevailed before 1987). Depreciation deductions are indexed, or, as an alternative, the present value of depreciation calculated at a discount rate of 7.5 percent may be deducted fully in all regions except large metropolitan areas and in all sectors except the automobile industry. In metropolitan areas, only 60 percent of such value can be deducted in the first year and the remaining 40 percent subject to capital consumption allowances.

Dividend Income. Starting in 1989, dividends were no longer deductible by the corporation distributing them nor could they be included in the gross income of the recipient. The withholding tax on dividend distributions varies with the source (whether or not paid from accumulated earnings already taxed--the net tax profit account--or paid from untaxed other sources) and with the tax regime faced by the recipient, as follows:

	Withholding Tax Rate on Dividends Paid (%)	
Recipient	From the net tax profit account	From other sources
Individuals or nonprofit organizations, resident or nonresident in Mexico	10	40
Resident corporations	None	35
Foreign corporations:		
Home tax rate on foreign dividend income at 30 percent or more	None	35
Home tax rate on foreign dividend income at less than 30 percent	10	40

Interest Income and Royalties. Beginning in 1991, the withholding tax rate on interest income will be 35 percent and the rate on payments for technical assistance, know-how, the transfer of technology, and fees paid to nonresidents (including royalties for patents when licensed in connection with the rendering of technical assistance) will be 21 percent. Payments for the use of other royalties such as for the licensing of trade marks or trade names, or patents without the rendering of technical assistance, will taxed at 40 percent.

Goods in Bonded Warehouses. These goods are subject to a 3 percent tax either on the value on which import duties are assessed or on the declared value, whichever is greater.

Profit Sharing. All businesses in Mexico are obliged to share 10 percent of their profits with employees.

Social Security and Payroll Taxes. Employers are obliged to contribute to social security coverage for workers (11 percent of workers' weekly wages), children's nurseries (1 percent of wages), and an occupational risk fund (from 5 to 167 percent of wages). In addition, employers contribute 5 percent of wages to the National Housing Fund and 1 percent of wages in support of education.

Value Added Tax. The general 15 percent rate of the value added tax (VAT) is applicable to all transactions concluded in the border and free zones.

Assets Tax. An assets tax at a rate of 2 percent of the average value of total assets of business enterprises and creditable against their income tax liability in Mexico, is levied effective in 1989.

Tax incentives regime in Mexico has undergoe significant changes over time. These are briefly discussed below:

1955-1972: Between 20% (for secondary industries) and 40% (for basic industries) corporate income of Mexican majority owned enterprises was exempted from corporate taxation for periods varying between five to ten years. The same industries also could receive, upon application, exemption from certain indirect taxes and import duties on capital goods imports.

1972-1979: Industries that were seen to promote decentralization and regional development were granted import duties relief varying from 50% to 100% and reduction in corporate tax liability ranging from 10% to 40% depending upon their location and type of activity.

1979-1986: The practice of import duty exemption was continued. In addition, tax incentives certificates (CEPROFIS) providing tax credit in the range of 10-25%, depending upon location, and type and size of the industry, for investment in physical assets were introduced. These certificates were negotiable and could be used against any federal tax liability by the holder.

1986-Present: The tax incentives certificates scheme was significantly tightened and targeted to priority industries and prefered zone (See Appendix Table A1). Top tax credit rate for CEPROFI was raised to 40% of total physical investment in 1986. In addition Mexican-owned enterprises are eligible for employment tax credit up to 30% of three times the annual area minimum wage

multiplied by the number of new jobs created. In addition, full expensing of the present value of capital consumption allowances calculated using a 7.5% discount rate was allowed in non-metropolitan areas. In the metropolitan industrialized areas of Mexico City, D.F., Monterrey and Guadalajara, only 60% of the present value of depreciation allowances could be deducted in the first year. R&D investment tax credit at 15% for the purchase of technological research (20% for small and micro enterprises), and 20% for capital purchases by technological enterprises (30% for small and micro enterprises) are currently permissible.

A summary view of the taxation of business income is given in Table A2 and details regarding forgone revenues due to fiscal incentives are repeated in Table A3-A-11.

Table A1

Mexico: Tax Credits for Investment (CEPROFIS) 1988

ZONES	1	2	3		
				Lower Priority	
Beneficiary	of highest national priority	of highest state priority	A: area of controlled growth	B: area of consolida-tion	remain-ing zones
Priority Industry:					
Category 1	30%	20%	none	none	15%
Category 2	20%	15%	none	none	10%
Small industry	30%	30%	none	20%	20%
Micro industry	40%	40%	none	30%	30%

Source: 1988 International Bureau of Fiscal Documentation, Supplement No. 71, June 1988.

Table A2

Mexico: Taxation of Business Income, A Comparative Perspective
(percent)

Tax regime	Mexico (1991)	United States (1990)	Canada (1990)
Corporate income tax rate: general[a]	35 + 3.9 = 38.9	34 + 6 = 40	28 + 15 = 43
Withholding tax rates			
Interest	35	30	28
Dividends	0-40	30	25
Technology transfer fees	21	30	25
Royalties	40	30	25
Indexation of deductions	Full	No	No
Loss carry forward	5	15	7
Loss carry backward	0	3	3
Minimum/alternative Minimum tax	2% assets tax	20% on taxable income inclusive of tax preferences	0.175% on capital in excess of $10 million creditable against 3% surtax on corporate profits
Capital gains taxation			
Coverage	Full	Full	Two-thirds
Indexation	Full	No	No
Rate	35	34	28
Dividends deduction	No	Yes	Yes
Full expensing of investment	No	No	No
Investment tax credits	Regional and prority sectors	Energy investment, rehabilitation of real estate, targeted job credit	Regional and R&D

a/ In Mexico the profit-sharing rate and, in the United States and Canada, the average provincial or state tax rates are added to the basic federal rate.

Source: Ugarte (1988), Price Waterhouse (1988, 1989), Mancera Hermanos (1989), International Bureau of Fiscal Documentation (1988), and Gil-Diaz (1989).

Table A3

Mexico: Fiscal Incentives 1980-1988
1980 = 100
(Millions of Pesos)

Year	Implied GDP Deflator	Fiscal Incentives 1/ (current prices)	Fiscal Incentives 1/ (1980 constant prices)
1980	100.0	22,046	22,046
1981	126.0	38,006	30,163
1982	202.8	53,753	26,505
1983	386.1	34,952	9,053
1984	614.4	37,192	6,053
1985	963.1	48,900	5,077
1986	1,679.5	109,152	6,499
1987	4,082.2	202,324	4,957
1988 2/	6,192.7	96,257	1,554

1/ Includes CEPROFIS, Agreement of Annual Validity, and Incentives for Export promotion.

Source: Instituto Nacional de Estadistica, Geografia e Informatica. - Secretaria de Programacion y Presupuesto - Dire General de Politica de Ingresos. S.H.C.P.

TABLE A4

REVENUE FOREGONE DUE TO GRANTING OF FISCAL INCENTIVES
BY TYPE OF FISCAL INCENTIVE MEASURE

(in Million Pesos)

INSTRUMENT	1983	%	1984	%	1985	%	1986	%	1987	%	1988	%
CEPROFIS	17,021	48.2	24,749	55.9	26,173	42.2	80,559	55.7	159,151	54.5	82,230	42.8
Agreements of Annual Validity	2,298	6.5	5,273	11.9	7,687	12.4	25,926	18.6	43,687	15.0	13,969	7.3
Border Areas and Duty Free Zones	4,780	13.5	6,030	13.6	17,187	27.7	25,143	18.0	75,687	26.0	50,222[3]	26.1
CEDIS	2,614	7.4	5,615	12.4	4,329	7.0	4,227	3.0	7,395	2.5	35,450	18.5
Other	8,584	24.3	2,575	5.8	6,699	10.8	3,784[1]	2.7	6,030[2]	2.0	10,257[4]	5.3
Total:	35,297	100.0	44,242	100.0	62,075	100.0	139,639	100.0	291,650	100.0	192,128	100.0

Source: Secretaria de Hacienda y Credito Publico

1/ Includes 2,227 million pesos of import tax returns to exporters (Drawbacks).

2/ Includes 5,689 million pesos of import tax returns to exporters (Drawbacks).

3/ January-June of 1988.

4/ Includes 10,257 million pesos of import tax returns to exporters (Drawbacks).

Table A5

Foregone Revenues Due to Investment Tax Credits (CEPROFIS)
By type of Instrument
1986 - 1988

		1986	%	1987	%	1988	%
A.	Investment and Employment	44,618	55.8	99,397	62.8	14,391	17.5
	of which:						
	(a) Priority Industries	35,622	44.6	81.564	51.5	9,611	11.7
	Most Favored	na	-	na	-	-	-
	Other	na	-	na	-	-	-
	(b) Small Industries	1,520	1.9	4,348	2.8	1,870	2.3
	Microindustry	157	0.2	440	0.3	168	0.2
	(c) National Machinery and equipment	6,715	8.4	12,246	7.7	2,665	3.2
	(d) Employment Generation	604	0.7	799	0.5	77	0.1
	(e)	-	-	-	-	-	-
B.	Mining and Metallurgy	8,353	10.5	22,999	14.5	4,340	5.3
C.	Basic Products (Milk)	3,133	3.9	6,440	4.1	9,938	12.1
D.	Industrial Development	94	0.1	1,510	1.0	80	0.1
E.	Technology Development	368	0.5	258	0.1	-	-
F.	Environment	na	-	na	-	-	-
G.	Merchant Fleet	17,437	21.8	13,547	8.6	1,492	1.8
H.	Other	5,917	7.4	14,163	8.9	51,989	63.2
	TOTAL	79,920	100.0	158,284	100.0	82,230	100.0

Source: Secretaria de Hacienda y Credito Publico

Table A6

Mexico: Foregone Revenues Due to Investment Tax Credits by Sector Activity
1979 - 1988
(in million pesos)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Agriculture and Forestry	1	8	18	776	1,736	676	1,705	4,273	10,028	31,468
Minerials	3	24	591	2,504	1,104	845	1,264	9,790	26,587	4,781
Manufacturing Industries	23	3,368	10,401	13,454	10,845	18,266	21,485	47,702	96,958	20,344
Construction	2	22	548	82	124	34	34	1,845	10,546	20,716
Electricity	-	-	33	106	36	147	404	158	2,711	12
Commerce and Hotels	n.r.	3	159	1,243	1,006	1,015	19	16	344	2,101
Transport and Communictions	66	174	829	1,634	619	2,781	2,056	16,225	9,596	855
Finance and Real Estate	n.r.	n.r.	34	183	21	3	3	5	212	279
Community Services	6	223	324	1,656	1,263	981	129	520	1,111	813
TOTAL	101	3,822	12,937	21,638	16,754	24,748	27,099	80,534	158,093	81,369

Source: Direccion General de Politica de Ingresos. S.H.C.P.

Table A7

Mexico: Foregone Revenues by Investment Tax Credits (CEPROFIS) by Manufacturing Industry
1979 - 1988
(in million pesos)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Food, Drinks and tobacco	1	402	583	1,597	1,124	1,448	1,337	2,673	6,830	3,043
Textiles	5	218	445	700	366	450	285	1,156	4,280	765
Wood and Wood Products	1	64	203	262	105	99	234	321	565	736
Paper and Paper products	-	123	215	560	345	547	809	1,598	3,439	7,151
Chemicals and Petroleum derivatives	5	165	1,521	2,365	1,235	1,768	2,270	3,627	11,025	4,669
Prod. non-metallic minerals	6	1,804	2,666	2,169	1,250	1,557	3,449	5,895	11,254	1,182
Basic metals	1	308	3,556	3,203	4,103	8,055	9,298	24,441	47,572	785
Metallic products, machinery and equipment	4	278	1,198	2,565	2,269	4,286	3,759	7,933	11,793	1,587
Other industries	-	6	14	33	48	56	44	58	200	426
TOTAL	23	3,368	10,401	13,454	10,845	18,266	21,485	47,702	96,958	20,344

Source: Direccion General de Politica de Ingresos. S.H.C.P.
May 16, 1989

TABLE A8

REVENUE FOREGONE DUE TO GRANTING OF FISCAL INCENTIVES
TO BORDER AREAS AND DUTY FREE ZOMES
1983-1986

(in Million Pesos)

INSTRUMENT	1983	%	1984	%	1985	%	1986	%	1987	%	1988	%
Tax exemption for the importation of basic and semi-basic products[1]	4,337	90.7	5,582	92.5	15,986	93.1	23,829	96.5	72,289	99.8	50,222[2]	99.9
Commercial Centers	131	2.7	167	2.8	267	1.6	-	-	161	0.2	58	0.1
Industrial Promotion	169	3.3	285	4.7	925	5.4	872	3.5	-	-	-	-
Other	153	3.2	-	-	-	-	-	-	-	-	-	-
TOTAL:	4,780	100.0	6,034	100.0	17,178	100.0	24,701	100.0	72,450	100.0	150,280	100.0

Source: Secretaria de Hacienda y Credito Publico

1/ The main goods included are chicken, cheese, butter, used tires and furniture, lard, domestic appliances, canned fruit and vegetables, auto parts, flour products, and clothing.

2/ January-June of 1988.

TABLE A9

FISCAL REVENUE LOSS DUE TO AGREEMENTS OF ANNUAL VALIDITY
1983 - 1988
By Type of Instrument

(in Million Pesos)

INSTRUMENT	1983	%	1984	%	1985	%	1986	%	1987	%	1988	%
Production of Cars and Components of which[1]	46	2.0	1,310	24.8	1,420	18.5	-	-	-	-	-	-
a) Components	N.A.	N.A.	369	7.0	0	0.0	-	-	-	-	-	-
b) Final Imports	N.A.	N.A.	0	0.0	0	0.0	-	-	-	-	-	-
c) Final Assembly	N.A.	N.A.	941	17.8	1,420	18.5	-	-	-	-	-	-
Imports of Primary Materials, Parts, and semimanufactured goods	839	36.5	1,781	33.8	4,146	53.9	13,604	62.8	37,027	92.9	924	12.0
Others[2]	1,413	61.5	2,182	41.4	2,121	27.6	8,048	37.2	2,846	7.1	6,804	88.0
a) Bottled Soft Drinks	-	-	-	-	-	-	8,000	37.0	2,739	6.8	6,804	88.0
b) Flower for Exportation	-	-	-	-	-	-	48	0.2	107	0.3	-	-
Total	2,298	100.0	5,273	100.0	7,687	100.0	21,652	100.0	39,873	100.0	7,728	100.0

Source: Secretaria de Hacienda y Credito Publico

1/ Not Effective in 1986.
2/ Mainly agreements to produce bottled soft drinks and to produce flowers for exportation.

TABLE A10

REVENUE FOREGONE DUE TO THE GRANTING OF FISCAL INCENTIVES
TO SUPPORT THE EXPORT SECTOR
1983-1988

by Type of Instrument

(in Million Pesos)

INSTRUMENT	1983	%	1984	%	1985	%	1986	%	1987	%	1988	%
CEDIS of which	2,614	100.0	5,615	100.0	5,451	89.0	4,227	65.5	7,395	56.5	35,450	77.6
1. Manufacturing	1,090	41.7	449	8.0	943	15.4	-	-	-	-	-	-
2. Trading companies	1,323	50.6	4,888	87.1	3,386	55.3	3,154	48.9	158	1.2	-	-
3. Technology and Services[N]	201	7.7	278	4.9	1,122	18.3	1,073	16.6	7,237	55.3	35,450	77.6
Import Tax Return to Exporters (Drawbacks)	0	0.0	0	0.0	671	11.0	2,227	34.5	5,689	43.5	10,257	22.4
TOTAL	2,614	100.0	5,615	100.0	6,122	100.0	6,454	100.0	13,084	100.0	45,707	100.0

Source: Secretaria de Hacienda y Credito Publico

N/ Mainly construction materials and services.

TABLE A11

DISTRIBUTION OF THE FISCAL INCENTIVES BY ECONOMIC ZONE

(Million current Pesos)

ECONOMIC ZONE	1986	%	1987	%	1988	%
Priority Areas:	37,987	48.5	93,664	63.6	11,412	74.4
IA:	20,850	26.6	75,594	51.3	9,191*	60.0
IB:	10,115	12.9	10,622	7.2		
II:	7,022	9.0	7,448	5.1	2,211	14.4
Controlled Areas	26,590	33.9	27,083	18.4	919	6.0
IIIA:	20,352	26.0	15,826	10.8	750	4.9
IIIB:	6,238	7.9	11,257	7.6	169	1.1
Rest of the country	13,818	17.6	26,490	18.0	2,993	19.6
Total:	78,395	100.0	147,237	100.0	15,314	100.0

Source: S.H.C.P.

*/ Includes Priority Areas IA and IB.

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